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**(54) Title: INSECT ATTRACTANT FORMULATION****(57) Abstract**

A solid attractant formula for insects comprising an intimate mixture of at least one thermoplastic material and at least one active ingredient capable of alluring insects to said attractant formulation.

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### Insect Attractant Formulation

The present invention is concerned with an insect attractant formulation.

Known insect attractant formulations tend to be difficult to handle, and often prove to be aesthetically unattractive products in practice.

For example, ammonia based attractant formulations often exhibit gassing problems during handling and storage.

Furthermore, insect attractant formulations are frequently used in liquid form. Suitable containers are provided for these attractant formulations wherein the active attractant ingredients are entrained in bulk liquid media. Problems associated with these attractant formulations include evaporation, dilution or spillage of the liquid media, which renders the formulations unsuitable for use in certain environments, such as extreme weather conditions or the like. In the case of sugar based liquid formulations, rapid loss of water yields sticky residues which become littered with dead insects.

We have now developed an insect attractant formulation which alleviates the above problems.

According to the present invention there is provided a solid attractant formulation for insects, said attractant formulation comprising an intimate mixture comprising at least one thermoplastic material and at least one active ingredient capable of alluring insects to said attractant formulation.

It is preferred that the thermoplastic material can be thermally formed at temperatures up to about 100°C. Typically the thermoplastic material has a melting point of about 40 to 70°C. The thermoplastic material can comprise any of ethylene-vinyl acetate co-polymer (EVA), polyethylene and wax. Advantageously the thermoplastic material comprises EVA.

Preferably the thermal forming of the thermoplastic material comprises any suitable technique, such as injection moulding, extrusion, casting or the like. Advantageously the intimate mixture of the thermoplastic material and active ingredient are subjected to injection moulding to produce the desired solid attractant formulation.

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Advantageously the active ingredient is capable of generating at least one insect-attractive moiety. Typically the insect-attractive moiety comprises a volatile attractant.

According to a first aspect of the present invention, the active ingredient comprises at least one ammonium salt capable of generating ammonia. A preferred ammonium salt comprises ammonium bicarbonate.

Preferably the ammonium salt is present in an amount by weight at least equal to the amount by weight of the thermoplastic material. Typically, the ammonium salt is present in an amount of 60 to 80% by weight, based on the weight of the thermoplastic material.

The formulation according to the first aspect of the present invention may further comprise at least one filler material.

According to a second aspect of the present invention the active ingredient comprises at least one liquid component such as yeast autolysate, suitable for incorporation into a solid insect attractant formulation according to the present invention and being capable of generating volatile attractants, whereby the attractant formulation comprises an intimate mixture comprising the active ingredient, at least one thermoplastic material and at least one filler material.

Typically the autolysate is prepared by enzymic or acidic lysing, and is preferably present in the attractant formulation in an amount of about 30 to 40%.

According to a third aspect of the present invention the active ingredient comprises at least one oleophilic insect-attractive moiety suitable for intimately mixing with the thermoplastic material. Preferred such moieties include t-butyl-2-methyl-4-(or 5-) chlorocyclohexylcarboxylate and 4- (p-hydroxyphenyl)-2-butanone acetate, the former being a preferred attractant for *Ceratitis capitata* (mediterranean fruit fly) and the latter being a preferred attractant for *Dacus cucurbitae* (melon fruit fly).

Preferably, the filler material comprises an absorbent mineral or vegetable material. Suitable such mineral materials include silica (which is preferred) and diatomaceous earth. Suitable such vegetable materials include cellulosic materials, such as starch.

It is preferred that the attractant formulation according to the present invention is formed by dispersing the active ingredient into the filler material, prior to intimate mixing with the thermoplastic material and subsequent thermal forming.

There is further provided by the present invention a method of preparing a solid attractant formulation for alluring insects, substantially as hereinbefore described, which method comprises:

- (a) intimately blending together at least one thermoplastic material and at least one active ingredient capable of alluring insects to the resultant attractant formulation; and
- (b) thermally forming the blend of step (a) so as to produce a moulded article suitable for use in alluring insects.

The thermoplastic material, active ingredient and thermal forming are substantially as hereinbefore described.

According to the first aspect of the present invention, step (a) comprises intimately blending together at least one ammonium salt and at least one thermoplastic material, and optionally at least one filler material.

According to the second aspect of the present invention, step (a) comprises blending together yeast autolysate, at least one thermoplastic material and at least one filler material.

The method according to the second aspect of the present invention preferably further comprises lysing whole yeast cells, typically by enzymic or acidic (such as HCl) treatment, prior to step (a).

Preferably the active ingredient is dispersed into the filler material, prior to blending with the thermoplastic material.

The present invention will now be further illustrated by the following examples which do not limit the scope of the invention in any way.

#### Example 1

This example describes an experiment carried out to investigate the release profile of an attractant from a formulation according to the present invention.

Insect attractant formulations each weighing 18g and having the dimensions 4.5cm x 8.4cm x 0.5cm and each containing approximately 11g of ammonium bicarbonate salt were allowed to stand within a covered building at a temperature ranging from 10 to 43°C over a period of 103 days. During that time, the attractant formulations lost weight linearly, and at the end of the experiment, the attractant formulations each weighed 7.8g. The weight loss, presumed to be due to the decomposition of the salt into ammonia, carbon

dioxide and water, equated to 80 percent of the original loading and to 80mg loss of salt per day.

Example 2

Insect attractant formulations as described in Example 1 were exposed to environmental conditions, with temperatures ranging from 0 to 25°C. 38% of the salt was released, which approximated to a rate of about 47mg/day. The apparently slower release outside compared to within the building was thought to be due to absorption of moisture into the attractant formulation and the lower temperature profile outside.

Example 3

This example describes the bio-efficacy of attractant formulations according to the present invention.

Ammonium-salt containing wax attractant formulations (blocks, 21cm x 2.1cm x 1.0cm, wt 9g, 7.5g of ammonium bicarbonate) were tested as lures for *Dacus oleae* (olive fruit fly) under a daily temperature cycle of approx 15-35°C for 120 days. The attractant formulations were found to be efficacious for that period of time, with no observable decline in alluring capacity.

Example 4

200 parts by weight of Z,E/Z,Z-7,11-hexadecadienyl acetate (*Gossyplure*) was carefully absorbed into 100 parts by weight of silica (Ultrasil VN3, Degussa). 12 parts by weight of this mixture was then intimately mixed with 88 parts by weight of EVA polymer chip (Elvax760, Du Pont), and extruded into ribbon approximately 1 mm thick. Circular pieces of the ribbon 10 mm in diameter were cut and placed in a wind tunnel operating at 27°C, and wind speed 5 mph. Some of the circular pieces were removed at various times and analysed for residual *Gossyplure* by gas chromatographic analysis. It was found that 65.8% of *Gossyplure* had been released linearly during a period of 45 days.

Example 5

12 parts by weight of the *Gossyplure*/silica mixture described in Example 1, was intimately mixed with 88 parts by weight of LDPE (STAMYLAN LD2300, DSM) and extruded into ribbon approximately 1 mm thick. In a wind tunnel experiment similar to that described in Example 4, it was found that 79.6% of *Gossyplure* had been released linearly during a period of 45 days

Claims:

1. A solid attractant formulation for insects comprising an intimate mixture of at least one thermoplastic material and at least one active ingredient capable of alluring insects to said attractant formulation.
2. A formulation according to claim 1, wherein said thermoplastic material can be thermally formed at temperatures up to 100°C.
3. A formulation according to claim 1 or 2, wherein said thermoplastic material has a melting point of from 40 to 70°C.
4. A formulation according to any of claims 1 to 3, wherein said thermoplastic material is an ethylene-vinyl acetate copolymer (EVA), a polyethylene or a wax.
5. A formulation according to any of claims 1 to 4, which is in the form of an injection moulding, extrusion or thermal casting.
6. A formulation according to any of claims 1 to 5, wherein said active ingredient comprises a volatile attractant.
7. A formulation according to claim 6, wherein said active ingredient comprises at least one ammonium salt capable of generating ammonia.
8. A formulation according to claim 7, wherein said ammonium salt comprises ammonium bicarbonate.
9. A formulation according to claims 7 or 8, wherein said ammonium salt is present in an amount by weight at least equal to the amount by weight of said thermoplastic material.
10. A formulation according to claim 9, wherein said ammonium salt is present in an amount of 60 to 80% by weight, based on the weight of said thermoplastic material.

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11. A formulation according to any preceding claim, in which said active ingredient comprises at least one liquid together with at least one filler material.
12. A formulation according to claim 11, wherein said filler material comprises an absorbent mineral or vegetable material.
13. A formulation according to claim 12, wherein said filler comprises silica.
14. A formulation according to any of claims 11 to 13, which is formed by dispersing said active ingredient into said filler material, prior to intimate mixing with said thermoplastic material and subsequent to thermal forming.
15. A formulation according to any of claims 11 to 14, in which said active ingredient comprises at least one liquid.
16. A formulation according to claim 15, wherein said liquid is a yeast autolysate.
17. A formulation according to claim 16, wherein said autolysate is prepared by enzymic or acidic lysing.
18. A formulation according to claims 16 or 17, wherein said autolysate is present in an amount of 30 to 40% by weight of the formulation.
19. A formulation according to any of claims 1 to 14, wherein said active ingredient comprises at least one oleophilic insect-attractive moiety.
20. A formulation according to claim 19, wherein said insect-attractive moiety comprises t-butyl-2-methyl-4-(or 5)-chlorocyclohexylcarboxylate or 4-(p-hydroxyphenyl)-2-butanone acetate.
21. A method of preparing a solid attractant formulation for alluring insects, according to any preceding claim, which method comprises:
  - (a) intimately blending together at least one thermoplastic material and at least one active ingredient capable of alluring insects to the resultant attractant formulation; and

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- (b) thermally forming the blend of step (a) so as to produce a moulded article suitable for use in alluring insects.
- 22. A method according to claim 21, wherein step (a) comprises intimately blending together at least one ammonium salt and at least one thermoplastic material, and optionally at least one filler material.
- 23. A method according to claim 22, wherein step (a) comprises blending together yeast autolysate, at least one thermoplastic material and at least one filler material.
- 24. A method according to claim 23, wherein step (a) further comprises lysing whole yeast cells, prior to step (a).
- 25. A method according to any of claims 22 to 24, wherein said active ingredient is dispersed into said filler material, prior to blending with said thermoplastic material.

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 A01N25/10 // (A01N25/10, 63:02, 37:10, 37:02, 33:12)

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 A01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE,A,35 15 866 (BASF AG) 10 July 1986  see page 3, line 37-44 see example p. 5. ---	1,5,6, 11-15, 19,21
X	US,A,5 135 744 (ALEXANDER SAMUEL R ET AL) 4 August 1992  see column 2, line 56 - column 3, line 16 see column 9, line 50 - column 10, line 22 ---	1-6, 11-15, 19,21
X	US,A,4 842 860 (SUGIURA HISAO ET AL) 27 June 1989  see column 1, line 56 - column 2, line 9 see example 1 ---	1-6, 11-15, 19,21
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 Further documents are listed in the continuation of box C. Patent family members are listed in annex.

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8 Date of the actual completion of the international search

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## C(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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